

# Technical News Bulletin

of the

National Bureau of Standards

★ Issued Monthly

Washington

JUNE 1936

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JUN 16 1936

DETROIT

Number 230

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### FOURTEENTH ANNUAL CONFERENCE STATE UTILITY COMMISSION ENGINEERS

The Fourteenth Annual Conference of State Utility Commission Engineers was held at the Bureau on May 21 to 23, inclusive. Twenty-six engineers, representing the States of Alabama, Arkansas, Connecticut, Illinois, Iowa, Maine, Maryland, Massachusetts, New Hampshire, New Jersey, North Dakota, Ohio, Vermont, West Virginia, and Wisconsin attended the sessions. Representatives from the Federal Communications Commission, the Federal Power Commission, the Interstate Commerce Commission, and the Bureau of the Census were present at one or more sessions. The total attendance was 48. It was generally agreed that the program of the fourteenth conference was the most interesting and useful of any conference so far held.

The following papers were read: Appraisal of Telephone Properties, P. L. Holland, Maryland; Supervision of Meter Accuracy, R. G. Warner, Connecticut; Discussion of the Safety Requirements of the Bureau of Motor Carriers, Interstate Commerce Commission, H. H. Kelly and H. H. Allen, Interstate Commerce Commission; The Activities of the Tennessee Valley Authority, M. R. Williams, Tennessee; Discussion of the Costs of Rural Electric Service—Past and Prospective, C. B. Hayden, Wisconsin; A Written Discussion of Mr. Hayden's Paper, E. Irvine Rudd, Connecticut; Investigation of Accidents and Suggestions for Their Prevention, J. P. Wadhams, Connecticut; Federal Communications Commission Activities, W. D. Humphreys, Federal Communications Commission; The Passamaquoddy Tidal Power Project, J. E. Goodwin, Maine; Lessons From Floods, J. P. Wadhams; Discussion of Safety

Glass for Public Vehicles, introduced by E. I. Rudd.

It is regretted that no copies of these papers are available for distribution to State utility commission engineers that were unable to attend the conference. It may be possible to obtain copies of some of the papers by addressing the author, care of the public service commission of the State represented by him.

The conference was in charge of an executive committee of commission engineers as follows: P. L. Holland (chairman), chief engineer, Public Service Commission of Maryland; A. B. Greene (vice chairman), telephone engineer, Florida; E. H. Morris, chief engineer, West Virginia; M. R. Williams, chief engineer, Tennessee.

The executive committee elected to make the arrangements for the 1937 conference is as follows: Chairman, A. B. Greene, Florida; vice chairman, J. E. Goodwin, Maine; J. H. Wiley, North Dakota; I. F. McDonnell, Sr., Alabama; W. R. Dwyer, Ohio.

J. Franklin Meyer, National Bureau of Standards, Washington, D. C., is secretary of the Conference.

#### MEETING OF METALLURGICAL ADVISORY COMMITTEE

One of the most effective means which the Bureau has for forming contacts with industry along metallurgical lines is its Metallurgical Advisory Committee. This body, which has been functioning continuously for 22 years, is composed of representatives appointed by the leading metallurgical technical societies and is under the chairmanship of Dr. G. B. Waterhouse, professor of metallurgy, Massachusetts Institute of Technology. The annual meeting was held at the Bureau on May 15, and of the 34 members all but 3 were present either in person or by proxy.

The following topics were discussed at this meeting: A definition of cast iron for use by the National Bureau of Standards which would serve as a criterion in disputes which might possibly lead to legal action; a new foundry technique for casting transverse test bars of cast iron; new researches on corrosion of piping materials under service conditions, and air-conditioning equipment; metals for use in low-cost housing, such as varied uses of sheet steel and soldered plumbing fittings; a criterion for determining the degree of purity of metals of exceedingly high purity; high elastic steels for aircraft uses; significance of

elongation and ductility especially for specification purposes; and aluminum forging alloys for aircraft propellers.

No reports are issued on any of the discussions taking place at these meetings.

#### THERMAL EXPANSION OF COPPER-BERYLLIUM ALLOYS

An investigation of copper-beryllium alloys which have come into industrial use during the past few years was undertaken to determine the effects of chemical composition and treatments on expansion. The beryllium contents ranged from 1.3 to 3.0 percent, results previously obtained on other properties having indicated that this range included the useful alloys. The results, which are set forth in detail in RP890 in the June number of the Journal of Research, will be valuable to the electrical and aviation industries.

1. The expansion curves of quenched copper-beryllium alloys containing 1.33 and 2.14 percent of beryllium showed critical regions which may be associated with structural changes accompanying aging.

2. Stabilization of copper-beryllium alloys may be accomplished either by tempering or by cold-working.

3. There is no simple relation between the coefficients of expansion, chemical composition, and heat treatment of the copper-beryllium alloys investigated. Figure 14 of the publication indicates the effects of beryllium content, cold-work, and heat treatment on the coefficients of expansion of these alloys.

4. The following table gives the ranges of the coefficients of expansion:

Beryllium content	Average coefficients of expansion <sup>1</sup> per degree C		
	20 to 100° C.	20 to 200° C	20 to 300° C
%	$\times 10^{-6}$	$\times 10^{-6}$	$\times 10^{-6}$
0.00.....	16.8(2)	17.2-17.3(2)	17.6-17.8(2)
1.33.....	16.4-17.0(14)	16.9-17.3(11)	17.3-18.1(8)
2.14.....	16.5-16.7(9)	16.6-17.1(8)	17.5-18.0(7)
3.03.....	15.9-17.3(6)	16.0-16.9(4)	16.4-17.4(4)

<sup>1</sup> This table does not include coefficients of expansion for temperature ranges in which critical regions were observed. Each number in parentheses represents the number of expansion determinations.

The coefficients of expansion of the copper-beryllium alloys do not differ from the corresponding value for copper by more than 8 percent of the latter value, whereas differences for the hardness, tensile strength, elongation,

and reduction of area, as shown in figure 8 of the publication, are considerably greater. For example, the tensile strength of copper-beryllium alloys may be more than four times as great as the tensile strength of copper.

5. The changes in length, density, and volume noted for both the quenched and the hard-drawn alloys are somewhat larger than the small changes noted for the aged alloys. The changes in length, volume, and density of quenched copper-beryllium alloys depend upon the temperature and time of aging. The density of copper-beryllium alloys decreases with increase of beryllium.

#### HEAT TREATMENT OF STEEL

The frequent inquiries that come to the Bureau for reasonably brief and simplified statements of the production, properties, and heat treatment of iron alloys have led to the publication of Bureau Circular C409, on this subject. This circular discusses very briefly the production and properties of wrought iron, pig iron, and cast irons, and, in somewhat more detail, treats of the more recent theories of the hardening of steels during quenching and the role of the alloying elements which are used in alloy steels. The circular includes also a brief bibliography of publications suggested for further reading on and study of the elementary principles of general metallurgy and heat treatment of steels.

Copies of this publication are obtainable from the Superintendent of Documents, Government Printing Office, Washington, D. C., at 10 cents each.

#### ALTERNATING-CURRENT MAGNETIC COMPARATOR FOR TESTING TOOL-RESISTING PRISON BARS

Prison bars are required to be tool resisting. In the interest of security it is essential to be able to test them by some nondestructive method. The usual mechanical tests are not applicable on account of the peculiar construction of the bars, in which the tool-resisting quality is provided by hardened-steel inserts. These are entirely surrounded by soft steel, which imparts the necessary degree of toughness and prevents easy access to the interior.

The Bureau has cooperated with the Federal Bureau of Prisons in the investigation of magnetic methods for testing tool-resisting prison bars. In the course of this investigation an alternating-current magnetic comparator

has been developed which is suitable for testing not only prison bars, but also other types of steel and steel products.

The apparatus is simple to operate, portable, and fairly rugged. It takes current from the ordinary alternating-current lighting circuit. It is fully described in the June number of the Journal of Research (RP894).

#### TESTS OF EIGHT LARGE H-SHAPED COLUMNS FABRICATED FROM CARBON-MANGANESE STEEL

High-strength steel is being used more and more as a substitute for low-carbon steel in structures such as bridges and buildings, because of the substantial saving in material thus brought about. However, experience with this relatively new material is needed to develop the most satisfactory designs for the different structural members.

Columns are an important part of any structure, but comparatively few tests have been made on large columns fabricated from high-strength steel. It was because of this lack of information that the Port of New York Authority requested the cooperation of the Bureau in determining the strength and behavior under load of large H-shaped columns fabricated from carbon-manganese steel plates and angles. As a result, eight columns were tested and the properties of the material determined by tensile tests of coupons.

The strength of seven of these columns exceeded the capacity of the testing machine, which is 10,000,000 pounds.

All the columns deflected in a direction perpendicular to the web.

The results of these tests, which will be published in detail in the June number of the Journal of Research (RP896), indicate that large riveted columns of carbon-manganese steel, similar to these test columns, have satisfactory strength and behavior under load.

#### TESTS OF STEEL CHORD COLUMNS FOR THE KILL VAN KULL BRIDGE

Compression members of steel structures, such as columns, may fail by buckling of outstanding legs of angles or of wide, thin cover plates.

The bridge department of the Port of New York Authority when designing the lower chord members of the Kill van Kull Bridge between Port Richmond, Staten Island, N. Y., and Bayonne, N. J., used large double-box type compression members made of carbon-

manganese steel. Because the width of these cover plates was large compared with their thickness, the port authority requested the cooperation of the Bureau in an investigation of the behavior of these lower chords under load, particularly to determine whether buckling of the cover plates would cause failure of the members under loads less than their estimated strength.

Two columns were, therefore, tested and it was found that the lateral deflection was very small until the stresses were nearly the maximum. Under a stress of about 38,000 lb/in.<sup>2</sup> the two cover plates began to buckle for their entire length. The results were in substantial agreement with the values obtained by the use of Bryan's formula for the compressive stress under which wide plates in ships may be expected to buckle. After these tests the chord members of the Kill van Kull Bridge were redesigned to eliminate the possibility of buckling of the cover plates.

A complete report of this work will be published as RP897 in the Journal of Research for June.

#### SIMPLIFICATION OF PAVING BRICK

The permanent committee on the simplification of varieties and sizes of vitrified paving brick, which met in Washington on April 16, carried out the fifteenth annual review of Simplified Practice Recommendation R1, Vitrified Paving Brick, and drafted the ninth revision of this recommendation. The committee voted unanimously to propose to the industry the following revisions:

- (1) Elimination of the 2½- by 4- by 8½-inch plain wire-cut brick (vertical fiber lugless).
- (2) Elimination of the 3- by 4- by 8½-inch plain wire-cut brick (vertical fiber lugless).

Shipments of the first item, which in 1934 amounted to 9.7 percent, in 1935 continued the rapid decline which commenced in 1933. The second item has assumed a trend similar to the first item, dropping from 5.9 percent to 3.3 percent. The four recognized varieties remaining in the simplified practice recommendation represent 79.3 percent of total sales of vitrified paving brick. To this survey, upon which the revision is based, 98 percent of the total capacity of the industry contributed information.

When this recommendation was first proposed, in 1922, there were 66 different sizes and varieties of vitrified paving brick. Since then the variety

has been reduced to four, representing an elimination of more than 93 percent.

#### DETERMINATION OF SILICA IN PORTLAND CEMENT

The numerous uses of portland cement in the building industry are increasing every year, and physical and chemical tests are badly needed to determine the suitability of various types of cement for special purposes. Up to the present time a complete chemical analysis of a portland-cement sample has been a lengthy undertaking, a large part of the time having been occupied in the determination of silica alone. In an investigation at the Bureau, described in the June number of the Journal of Research (RP891), it was found that an accurate determination of silica in portland cement can be made in a few hours. If ammonium chloride is mixed with the cement before the latter is dissolved in concentrated hydrochloric acid, and the solution is digested on the steam bath for 30 minutes, the silica can be filtered off without the customary double evaporation of the solution.

#### DETERMINATION OF SULPHURIC ANHYDRIDE IN PORTLAND CEMENT BY MEANS OF THE WAGNER TURBIDIMETER

In the manufacture of portland cement it is the general practice to add calcined gypsum during the final grinding. The gypsum content must be carefully controlled and therefore many determinations of sulphuric anhydride must be made in cement-testing laboratories. The standard method for this determination requires several hours. As a result of investigations at the Bureau, a turbidimetric method has been developed which reduces the time occupied in a single determination to a few minutes and yet gives results which are sufficiently accurate. This method makes use of the Wagner turbidimeter, originally developed at the Bureau to measure the specific surface of cement. Those interested in details of the method should consult RP893 in the June number of the Journal of Research.

#### STAINING TEST FOR CEMENTS

Some of our most widely used limestones have discolored, in many instances, when used with either natural or portland-cement mortars. The discoloration is usually brown, and the stained areas ordinarily occur adjacent to the mortar joints. The appearance

of the stain has led many to assume that it was caused by the iron impurities in the cement. This theory was disproved by studies at the Bureau several years ago, when it was found that the stain originated from organic matter occurring in the stone. It was also found that the iron impurities of the cement took no part in the staining, but some other elements, such as water soluble alkalies, apparently dislodged the organic matter from the minute voids in stone.

Experience has indicated that some brands of cement do not cause appreciable staining when used for setting the stone, while others frequently cause unsightly discolorations. For this reason some architects have specified nonstaining cements and often some particular brand believed to be free from staining properties. As the composition of any given brand of cement may vary appreciably from time to time one cannot always rely on past experience; hence it is desirable to have a test to determine whether the particular consignment of cement is nonstaining. Two methods have been used for this purpose, one of which depends on the amount of water-soluble alkalies in the hydrated cement, and the other consists of leaching a joint of the cement mortar in contact with a sample of the limestone. These tests often fail to give concordant results when applied to the same sample.

Laboratory experiments, as well as discoloration on buildings, lead to the belief that the organic matter causing the stain is not uniformly distributed throughout the stone, and hence a test made with any cement on a sample of stone is apt to give misleading results. During the past year studies have been made on a means of eliminating the effect of segregated staining matter and a procedure has been found which has, apparently, overcome the uncertainties of the results. This employs the use of crushed stone rather than a sample in its natural state. By crushing a large sample of the stone and thoroughly mixing, a uniform mass is obtained which can be used as a standard for testing numerous samples of cement. Considerable difficulty was experienced in finding a process that would give a positive test with crushed stone because it does not discolor as readily as stone in its natural state.

A mixture of the cement and water is made and allowed to harden for 48 hours, after which it is crushed to pass a no. 4 sieve. 140 g of the cement is tamped around a  $\frac{3}{8}$ -in. glass tube cen-

tered in a glass vessel approximately 3 in. in diameter and  $4\frac{1}{2}$  in. high. Over this is tamped 375 g of the crushed-stone sample. The remaining portion is then filled with stone dust passing a 100-mesh sieve and leveled off.

Sixty-five ml of distilled water is poured down the tube. When the moisture rises to the top of the stone dust the mass is compacted and leveled off with a trowel, after which a filter paper, through which the tube projects, is sealed down and crimped over the edge of the vessel. The specimen is then dried at 50° C for 48 hours, and the discoloration forms on the filter paper. A quantitative measurement of the discoloration may be made with a reflectometer.

#### THE SYSTEM LIME-BORIC-OXIDE-SILICA

The close similarity of boric-oxide and silica and especially their property of limited miscibility in the liquid state with oxides of certain of the alkaline earths and other divalent elements renders a study of the system  $\text{CaO-B}_2\text{O}_3\text{-SiO}_2$  of unusual theoretical interest. From the practical viewpoint the system is equally worthy of investigation, for the high-silica boric-oxide portion has a bearing upon the constitution of borosilicate glasses, enamels, and ceramic glazes, while the high-lime portion shows the effect of boric-oxide upon the calcium silicates occurring in portland cement. The investigation of this last point furnished the initial motive for the study, which, it was thought, might indicate the possibility of producing a well-burned clinker at a relatively low temperature by the use of boric-oxide as a flux. The investigation of the system  $\text{CaO-B}_2\text{O}_3\text{-SiO}_2$  has now been completed. Other reports which have been made relative to this study are: Effect of boric acid on the clinkering of portland cement, *Technical News Bulletin* 157 (May 1930); The system  $\text{CaO-B}_2\text{O}_3$ , *Technical News Bulletin* 186 (October 1932); The system  $\text{CaO-B}_2\text{O}_3$ , by E. T. Carlson, *BS J. Research* 9, 825 (1932) RP510; and The system  $\text{CaO-B}_2\text{O}_3\text{-SiO}_2$ , *Technical News Bulletin* 208 (September 1934).

A distinctive feature of this system is its concentration range in which mixtures melt to give two immiscible liquids, one containing less than 1 percent of lime and the other a maximum of 38.5 percent of lime. The first crystalline material to appear on cooling such liquid mixtures may be either silica, monocalcium borate, or calcium



diborate. Such behavior is unique and has been observed in no other ternary oxide system.

The fields of stability of the various calcium silicates and borates and of a ternary compound,  $5\text{CaO} \cdot \text{B}_2\text{O}_3 \cdot \text{SiO}_2$  have been established by quenches and heating curves upon 200 compositions. The mineral danburite,  $\text{CaO} \cdot \text{B}_2\text{O}_3 \cdot 2\text{SiO}_2$ , was not obtained as a crystalline phase. Its composition lies in the immiscible liquid portion of the monocalcium borate field.

Dicalcium silicate, one of the constituents of portland cement, was found to form partial solid solutions with the calcium borates, whereby its alpha-beta inversion temperature is lowered by a maximum of  $190^\circ \text{C}$ .

The nonappearance of tricalcium silicate (the other silicate occurring in portland cement) in the triangular diagram  $\text{CaO} \cdot \text{B}_2\text{O}_3 \cdot \text{SiO}_2$  is of significance. The region where this compound might be expected is occupied by the ternary compound,  $5\text{CaO} \cdot \text{B}_2\text{O}_3 \cdot \text{SiO}_2$ , which does not possess appreciable hydraulic properties.

### THIRD SPECTRUM OF XENON

The third spectrum of xenon ( $\text{Xe III}$ ) characteristic of doubly ionized xenon atoms ( $\text{Xe}^{++}$ ) appears along with the second spectrum when a Geissler tube containing the gas is operated by an alternating-current transformer with condensers and spark gap in the discharge circuit. The partial or complete suppression of lines originating in ions of higher stage than the first by the insertion of varying amounts of inductance in the discharge circuit has been used to distinguish the lines of  $\text{Xe III}$  from those of the other xenon spectra. An analysis of wave-length measurements of xenon spark spectra, based mainly on observations with the Bureau's Rowland grating and extending from 2200 to 8900 Å is given in RP898 in the June number of the Journal of Research. The majority of the  $\text{Xe III}$  lines are in the near ultraviolet region. About 300 lines have been classified arising from 84 levels of  $\text{Xe III}$ .

The low states of  $\text{Xe}^{++}$  are  $^1\text{P}$ ,  $^1\text{D}$ , and  $^1\text{S}$ , due to the  $5s^2 5p^4$  configuration. The higher excited states are built upon the  $^1\text{S}$ ,  $^1\text{D}$ , and  $^1\text{P}$  states of  $\text{Xe}^{++}$  by the addition of an  $ns$ ,  $np$ , or  $nd$  electron to the normal  $5s^2 5p^4$  configuration. Complete quantum-number designations are given for about two-thirds of the levels. A sufficient number of levels are available to account for nearly all the terms belonging to the low and first excited states. Nu-

merous instances of mutual perturbations between terms causing a sharing of combining properties makes an unambiguous assignment of quantum numbers difficult or impossible in such cases. These perturbations apparently are also responsible for frequent and intense inter-system combinations as well as combinations between terms converging to different limits. The fact that all groups of terms are tied together permits an accurate calculation of their relative values. In all cases, permitted by the rules governing quantum transitions, the levels of first excited states combine with the low levels giving lines in the extreme ultraviolet region observed by J. C. Boyce. The absolute term values are arrived at from an estimation of the limit of the  $5s^2 5p^3 (^4\text{S}) nd ^1\text{D}^\circ$  series. The lowest  $4s^2 4p^3 ^2\text{P}_2$  levels comes out accordingly  $259,089 \text{ cm}^{-1}$ , equivalent to an ionization potential of 32.0 volts for  $\text{Xe}^{++}$ .

### DISSOCIATION CONSTANTS OF MALONIC ACID IN ITS SODIUM SALT SOLUTIONS

As described in RP895 in the June number of the Journal of Research, electrometric titration of 0.1 M malonic acid by 0.1007 N sodium hydroxide was completed at  $25^\circ \text{C}$ , for the determination of the pH titration curve and the calculations of the primary and secondary dissociation constants. The treatment of the data embodied the application of the Henderson equation for liquid-junction potential, the Debye-Hückel theory of interionic attraction, and the Guggenheim-Hückel expression for the variation of the ionic-activity coefficients with concentration. The dissociation constants found for malonic acid at  $25^\circ \text{C}$  are  $K_1 = 2.06 \times 10^{-3}$  and  $K_2 = 2.94 \times 10^{-6}$ .

### THERMAL MUTAROTATIONS OF *d*-GALACTOSE, *L*-ARABINOSE, AND *d*-TALOSE

It has been found that after lowering the temperature of aqueous equilibrium solutions of galactose, arabinose, and talose the optical rotation increases rapidly to a maximum and then decreases slowly. The first stage of this mutarotation is due to a change in the concentration of a labile modification of the sugars, about which very little is known. New measurements described in RP892 in the June number of the Journal of Research provide a means for studying this substance and for determining its mutarotation coefficient.

The effect of temperature on the composition of the equilibrium solutions and on the rates of mutarotation are discussed briefly and heats of activation calculated.

The optical rotation of  $\alpha$ -D-talose at 20° C and 0° C is reported for the first time; it exhibits a complex mutarotation which is represented by an equation containing two exponential terms.

#### OXIDATION OF WOOL: PHOTOCHEMICAL OXIDATION

Many substances, such as proteins, carbohydrates, and fats, deteriorate during exposure to light. The deterioration has been shown to be a photochemical oxidation. In the case of proteins and other nitrogenous materials, the oxidation process is generally accompanied by the formation of ammonia, which may be used as a measure of the deterioration.

Wool, which is relatively more stable to light than other textile materials, is also oxidized during irradiation. The reaction, however, appears to be of a somewhat different nature, owing to the differences in chemical constitution. The chief point of attack appears to be the disulfide group of the cystine in wool. An investigation, now in progress at the Bureau, was undertaken to extend the observations on reactions involving the disulfide group in wool, and to determine the effect of irradiation on the sulfur and nitrogen in wool protein.

In the course of this work, the photochemical decomposition of wool has been studied. The deterioration, as evidenced by the decrease in cystine content and the increase in alkali-solubility, ammonia nitrogen, and sulfate sulfur, is accelerated by acids and decelerated by alkalis. The extent to which wool is degraded during irradiation is directly proportional to the decrease in cystine content and to the increase in alkali-solubility.

The sulfur content of the untreated and acid-treated wool decreased during irradiation. The data suggest that a portion of the sulfur in wool is converted to hydrogen sulfide, some of which is subsequently oxidized to sulfuric acid.

#### TEXTILE FLAMEPROOFING

The subject of fireproofing has been one of great interest since ancient times. It is said that the Romans attempted to fireproof their houses and war vessels by dipping the wood in a

bath of vinegar and clay. Systematic research in the special field of textile flameproofing dates as far back as 1821, when Gay-Lussac published the results of an investigation suggested by Louis XVIII, in which he determined the flameproofness imparted by numerous chemicals when deposited on linen and hemp cloth.

Complete fireproofing of textiles—even making them fully resistant to charring and decomposition at high temperatures—has not yet been achieved, and is probably not possible. The most that can be expected of a flameproofed fabric is that it will resist ignition by a match or similar small source of heat, or that, if once ignited, it will not continue flaming upon removal of the source of ignition, since after a fire is well started, even a well-treated material will add fuel to the flame. Such flameproofing may be accomplished by impregnating the cloth with solutions of various chemicals, either singly or mixed.

These and other details of the history and principles of flameproofing are presented in the Bureau's new Letter Circular LC467, *Flameproofing of Textiles*, single copies of which are obtainable on request. The letter circular also includes an outline of the more important testing methods, a list of references, and formulas which have been recommended for making fabrics flameproof.

One of the formulas is that used in the Perkin process for cotton goods, in which water-insoluble stannic oxide is precipitated on and within the fibers by a chemical reaction between sodium stannate and ammonium sulphate. The cloth is first washed, then acidified with acetic or other weak organic acid, dried, and thoroughly saturated in a solution of 10.4 pounds of sodium stannate in 3 gallons of water, then squeezed and dried again. It is next run through a solution of 3.7 pounds of ammonium sulphate in 3 gallons of water, squeezed, dried, and washed in cold water. The goods should be heavily squeezed after passing through the solutions. The fire-retardant effects of this treatment will resist repeated washings.

Another formula is that developed by Kling and Florentin of the Paris Municipal Laboratory, which specifies the use of 1½ pounds of borax and 1¼ pounds of boric acid in 3 gallons of water. This treatment is not resistant to the action of water. It has been much used for flameproofing interior decorations in public places such as theater stages.

# STABILITY OF FILM SLIDES FOR RECORD PURPOSES

The following summary of the Bureau's work during the past year on the stability of film slides for record purposes was presented by B. W. Scribner, chief of the Paper Section, as part of a "microphotography round table" at the meeting of the American Library Association, in Richmond, Va., on May 12:

The study of the stability of motion-picture films for record purposes, now in progress at the Bureau, was undertaken as a natural extension of the work on the preservation of records written or printed on paper. Study of acetate films was initiated in June 1935 with the support of a fund allotted to the National Research Council by the Carnegie Foundation of New York. Later the National Archives also gave financial support to the undertaking, and because of the necessity for them to store nitrate films, the program was expanded to include this type.

To carry out these tests, new films of both types were secured from manufacturers, and old nitrate films were obtained from various depositories. It has not been possible as yet to obtain old acetate films.

In studying the films, conditions of extreme temperature and moisture are being used as accelerated aging tests, and the films are put through various cycles of temperature and humidity changes to find the optimum storage conditions. The tendency of the films to become brittle under such treatments is being studied by measuring the decrease in folding endurance. Chemical deterioration of the film base is being checked by determining whether any drop in viscosity of solutions made from the films, loss in weight, and increase in acidity occurs. In addition, the nitrate film is tested to determine the time required for acid fumes from the film to discolor a test paper on heating—a test used for guncotton.

When new nitrate films were heated in dry air at 100° C. and reconditioned, which is the accelerated aging test used for paper, they became permanently brittle in 10 days, and evidence of extreme chemical deterioration was found. Under the same conditions, new acetate films retained good flexibility, even after heating for 30 days, and showed little evidence of chemical change. On heating the films in an atmosphere of 95-percent relative humidity both types showed evidences of

deterioration, although the nitrate films again were much less stable than the acetate. On putting the films through a cycle of various humidity conditions, it was found that the nitrate films retained their flexibility better than the acetate on loss of moisture, and showed less dimensional changes. The acetate films became quite brittle at low humidity, but their flexibility and approximately their original dimensions were restored on exposing them to a medium degree of humidity.

While the evidence is not yet complete, that already obtained shows that acetate films offer considerable promise for use as permanent records, if properly made and if care is taken to prevent them from drying out too much. They should be stored in air having a relative humidity of about 50 percent. After they are used in the projection machine, they should be exposed to air of this humidity in such a way that the air has free access to all parts of the film, to restore moisture that may have been lost, and they should not be re-used until moisture equilibrium has been obtained. This moisture condition, plus a low temperature (not above about 50° F), is suitable for prolonging the life of nitrate films. Such conditions have been recommended by the Society of Motion Picture Engineers' Committee on Preservation of Motion Picture Films.

Other problems such as the use of protective coatings, effect of aging on the emulsion, and conditioning of films for storage are now being studied, but information on them is insufficient for a report at the present time.

# DECISION OF THE SUPREME COURT OF THE UNITED STATES AND ITS EFFECT ON ESTABLISHMENT OF COMMERCIAL STANDARDS

In opinion no. 268 of the October Term, 1935, the Supreme Court of the United States in the case of the Sugar Institute, Inc., et al., reviewed not only the situation affecting this case but other previous cases involving price fixing and among other things said:

Designed to frustrate *unreasonable restraints*, they (restrictions of the Sherman Anti-Trust Act) do not prevent the adoption of reasonable means to protect interstate commerce from destructive or injurious practices and to promote competition upon a sound basis. *Voluntary action to end abuses and to foster fair competitive opportunities in the public interest may be more effective than legal processes.* And cooperative endeavor may appropriately have wider objectives than merely the removal of evils which are infractions of positive law. Nor does the fact that the correction of abuses may tend to stabilize a



business, or to produce fairer price levels, require that abuses should go uncorrected or that an effort to correct them should for that reason alone be stamped as an unreasonable restraint of trade. Accordingly we have held that a cooperative enterprise otherwise free from objection, which carries with it no monopolistic menace, is not to be condemned as an undue restraint merely because it may effect a change in market conditions where the change would be in mitigation of recognized evils and would not impair, but rather foster, fair competitive opportunities.

It seems that this constitutes a definite and authoritative encouragement of voluntary action such as the establishment of commercial standards in correcting trade abuses. National laws may be written to prevent the sale in interstate commerce of goods which are definitely unsanitary or otherwise unfit for use, but voluntary standards can be set up for all grades or for the highest grade of any commodity, so as to place competition on a fairer basis; to bring about a better understanding between buyer and seller; and to give the buyer a basis for redress against the seller who definitely misrepresents his goods.

If the voluntary establishment of commercial standards (grade specifications) by business through the impartial and open procedure of the National Bureau of Standards results in a natural stabilization of prices and improvement of market conditions, such stabilization and improvement are not to be condemned. In fact, commercial standards mitigate recognized evils and do not impair, but rather foster, fair competitive opportunities.

**NEW AND REVISED PUBLICATIONS  
ISSUED DURING MAY 1936**

**Journal of Research<sup>1</sup>**

Journal of Research of the National Bureau of Standards, vol. 16, no. 5, May 1936 (RP881 to RP888, inclusive). Price 25 cents. Obtainable by subscription.

**Research Papers<sup>1</sup>**

[Reprints from the March 1936 Journal of Research]

RP868. Ionosphere studies during partial solar eclipse of February 3, 1936.

<sup>1</sup> Send orders for publications under this heading only to the Superintendent of Documents, Government Printing Office, Washington, D. C. Subscription to Technical News Bulletin, 50 cents per year; Journal of Research, \$2.50 per year (United States and its possessions, and Canada, Cuba, Mexico, Newfoundland, and Republic of Panama); other countries, 70 cents and \$3.25, respectively.

Samuel S. Kirby, Theodore R. Gilliland, and Elbert B. Judson. Price 5 cents.

RP869. Reversal temperature and population of excited states in the cesium discharge. Fred L. Mohler. Price 5 cents.

RP871. Distillation and separation of arsenic, antimony, and tin. John A. Scherrer. Price 5 cents.

RP872. Note on the effect of a cover glass in reflectance measurements. Deane B. Judd and Kasson S. Gibson. Price 5 cents.

RP873. Some tests of steel columns incased in concrete. Ambrose H. Stang, Herbert L. Whittemore, and Douglas E. Parsons. Price 10 cents.

**Circulars<sup>1</sup>**

C409. Production, heat treatment, and properties of iron alloys. Louis Jordan. Price 10 cents.

**Simplified Practice Recommendations<sup>2</sup>**

R67-36. Taper roller bearings. (Supersedes R67-33.) Price 5 cents.

R98-36. Photographic paper. (Supersedes R98-29.) Price 5 cents.

**Technical News Bulletin<sup>1</sup>**

Technical News Bulletin 229, May 1936. Price 5 cents. Obtainable by subscription.

**MIMEOGRAPHED MATERIAL**

**Letter Circulars**

Letter Circulars are prepared to answer specific inquiries addressed to the National Bureau of Standards and are sent only on request to persons having a definite need for the information. The number of copies available is limited. The Bureau cannot undertake to supply lists or complete sets of Letter Circulars or to send copies automatically as issued.

LC466. Procedure for testing women's full-fashioned silk hosiery with the National Bureau of Standards hosiery-testing machine.

LC467. Flameproofing of textiles.

LC468. Decision of the Supreme Court of the United States and its effect on the establishment of commercial standards.

**Technical Information on Building Materials**

The supply of these notes, each of which consists of 3 or 4 pages giv-

ing the important facts on some one aspect of the properties or use of building materials, is necessarily limited. Their distribution will be confined to Government officials concerned with building projects, and to architects, engineers, and home builders. Requests should make clear the actual need for the information at the time of writing. Letters should be addressed to the Division of Codes and Specifications, National Bureau of Standards, Washington, D. C. The following notes have been issued since the list published in the April 1936 number of the Technical News Bulletin:

**TIBM-10.** Corrosion of metals used in house construction: Atmospheric corrosion of ferrous metals.

**TIBM-11.** Paint for priming plaster surfaces.

**TIBM-12.** Thermal insulation: Insulating values for frame wall construction—wood siding with various types of interior finishes.

**TIBM-13.** Thermal insulation: Insulating values for frame wall construction—stucco with various types of interior finishes.

**TIBM-14.** Thermal insulation: Insulating values for frame wall construction—4-inch brick veneer with various types of interior finishes.

**TIBM-15.** Thermal insulation: Insulating values for frame wall construction—wood shingles with various types of interior finishes.

**TIBM-16.** Thermal insulation: Summary and conclusions.

#### OUTSIDE PUBLICATIONS\*

Gloss investigations using reflected images of a target pattern. R. S. Hunter. *J. Opt. Soc. Am.* (Cornell

University, Ithaca, N. Y.), **26**, 190 (1936), and *Sci. Sec. Cir., Nat. Paint, Varnish, and Lacquer Assn.* (Washington, D. C.), no. 503 (1936).

The evaluation of ultraviolet solar radiation of short wave lengths. W. W. Coblenz and R. Stair. *Proc. Nat. Acad. Sci.* (Washington, D. C.), **22**, 229 (April 1936).

Über die messung der ultravioletten anteile des sonnenlichtes für medizinische zwecke. W. W. Coblenz, Strahlentherapie (Deutschen Röntgengesellschaft und der Gesellschaft für Lichtforschung, Berlin, Germany), **55**, 545 (1936).

A symposium on thermodynamics. Modern thermochemistry. Frederick D. Rossini. *Chem. Reviews* (Williams and Wilkins Co., Baltimore, Md.), **18**, 233 (April 1936).

Ebulliometric determination of small amounts of water. M. Wojciechowski (guest worker, Polytechnic Institute, Warsaw, Poland). *Nature* (London, Eng.), **137**, 707 (April 25, 1936).

Rubber substitutes as coatings for balloon fabrics. T. P. Sager. *India Rubber World* (420 Lexington Ave., New York, N. Y.), **94**, 31 (1936).

Activities of the raw silk committee of the National Association of Hosiery Manufacturers. E. M. Schenke. *Am. Dyestuff Reporter* (90 William St., New York, N. Y.), **25**, 2126 (March 9, 1936) and *Am. Silk and Rayon J.* (373 Fourth Ave., New York, N. Y.), **55**, 24 (April 1936).

\*These publications are not obtainable from the Government. Requests should be sent direct to the publishers.

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